

examiner's attention is respectfully drawn to copies enclosed of excerpts from three primary source text book publications on the design of ultrasonic systems using resonant vibration: Ultrasonic Engineering by Alan Crawford, Ultrasonic Cutting by L. D. Rozenberg et al and Ultrasonic Engineering by Julian Frederick. Relevant descriptions in these excerpts have been identified by underline. These authors identically define the apparatus as consisting of a transducer, a resonating horn or concentrator and a tip or a tool. They also identify the terms concentrator, horn, velocity transformer or impedance transformer as being equivalent descriptions of the same functional element shown in Fig 171 (Crawford) and Fig. 64 (Rosenberg) and that the horn or concentrator is always designed to be resonant with the transducer. Resonance is defined by the Academic Press dictionary of science and technology, a copy of the excerpt attached, in physics, as "a phenomenon exhibited by a freely oscillating system in which the system's response has a large amplitude when driven by an externally applied oscillation at a frequency equal to the natural oscillation frequency of the system." Brokhny does not teach a resonant tip but rather a tip attached to a resonating horn that is driven at its resonant frequency by a transducer. Hence, Brokhny's tip, from his own description, is not a resonator.

The tip follows the motion of the resonator and cannot produce motion in and of itself. As U.S. 3,589,363 (Banko et al), cited as prior art by both the applicant and Boukhny, teaches in column 7, lines 42-46, the tip serves only to apply the vibration produced by the resonator horn in the needed way to the object of interest: "The operative tip 60, being firmly coupled to the output end of the impedance transformer 46, will be longitudinally vibrated thereby at the operating frequency and essentially with the amplitude available at the end of the output section 46b." Boukhny's invention and that of the applicant follow the primary teaching on the design of resonant ultrasonic instruments, given in the cited references, precisely. Each identifies a transducer, a resonator or horn and a tip. To perform the described objectives of both the applicant's and the invention of Boukhny, the tip must be attached to or mounted on a resonator or horn, which

he identifies as item 16, Fig. 1. The references cited teach that the tip can only produce the intended objective if it is attached to a resonating horn. Therefore, the tip disclosed by Boukhny, because it is described as a tip and not a resonator, can not, in and of itself, without connection to a resonator, produce the intended functions. Boukhny further emphasizes this important functional difference when he states that the asymmetry in his tip is completely unrelated to the production of longitudinal-torsional motion and discloses that his tip is only useful when attached to a resonating horn and transducer. His tip produces motion from a resonating horn that does not contain a spiral inhomogenous portion. In the applicant's invention, the applicant's tip produces motion it receives from a longitudinal-torsional resonator that does contain a spiral inhomogenous portion.

With particular reference to the cited teachings and the cited prior art, the applicant additionally respectfully directs the examiner's attention to column 4, lines 7 through 14, of U.S. 6,077,285 wherein the spiral asymmetrical shape is clearly defined as being part of the tip, item 12, whereas item 16 is described as the resonating horn. Nowhere in the specification of this patent is a spiral inhomogenous section shown between a connection point of the resonator and the tip. Boukhny clearly identifies the tip, in his figures 1 and 5, as being distinct from the resonating horn. Furthermore, in this citation, Boukhny clearly does not identify this feature of tip with the production of longitudinal-torsional motion, stating that its use is entirely confined to preventing the tip, using hydrodynamical forces, from loosening due to torsional motion produced by his resonating horn [col. 4, lines 7-14].

In the applicant's invention as disclosed and claimed, the spiral inhomogenous section occurs in a region between the contact point of the resonator for receiving vibration and the tip, which tip he also clearly distinguishes from the resonator as item 3, Figure 1, and in lines 3-7, page 9 of his specification: "The mechanical connection between the L-T resonator and the transducer and the L-

T resonator and the tip may be made by any of the common methods know in the art such by screw threads, press fit, welding, brazing or the connection may be metallurgically continuous.” Boukhny places asymmetry in the tip itself which he distinguishes from the resonator in column 1, lines 19-23: “The operative part of the handpiece is a centrally located, hollow resonating bar or horn directly attached to a set of piezoelectric crystals. The crystals supply the required ultrasonic vibration need to drive both the horn and the attached cutting tip during phacoemulsification and are controlled by the console.” The “operative part,” the resonating horn, item 16 of U.S. 6, 077, 285, does not contain a spiral inhomogenous section nor it is shaped asymmetrically.

Further in elaboration the applicant wishes to emphasize that Boukhny’s tip, while asymmetrically shaped, is defined as a tip, which term is well known and described by teachings accepted by those skilled in the art, and is in fact stated to perform the function of a tip – to be “ultrasonically vibrated along its longitudinal axis within the irrigating sleeve by crystal-driven ultrasonic horn” [Col. 1, lines 44-46], also well known to those skilled in the art, while the applicant’s tip communicates the motion it receives from a novel and unique resonator, a portion of which contains a spiral inhomogeneity. Boukhny further reinforces this distinction by describing his as a separate element from the resonator whose function is to replicate and convey whatever form of vibration it receives from resonator without alteration and whose asymmetrical shape serves only to prevent detachment.

The applicant has endeavored to distinguish his invention from all prior art, relying upon established teaching and definitions to show how the claims of the present application describe a useful, unique construction. He believes that the claims are in condition for allowance and respectfully requests the same

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